

REMARKS

Claims 1-25 remain pending in the present application. Claims 1, 2, 7, 10, 12, 13, 14 and 22-25 have been amended. Claim 26 is new. Basis for the amendments and new claims can be found throughout the specification, claims and drawings as originally filed.

REJECTION UNDER 35 U.S.C. § 112

Claims 1 through 3, 7, 11 through 13, and 22 through 25 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant respectfully traverses the rejection of the Examiner. Each limitation listed by the Examiner has antecedent basis in the claim or in a claim within its dependency tree.

Claim1:

“the boiling cooler”

Claim 1, line1

“the refrigerant vapor”

Claim 1, line1

“a heating element “ has been amended to “the heating element” which is introduced in line 1 of Claim 1.

Claim 2:

“the refrigerant vapor”

Claim 1, line 3

“the coolant”

Claim 2, line4

“the coolant passage”

Claim 2, line3

“the vapor passage”

Claim 2, line 2

Claim 3:

"the liquid surface"

Claim 3, line 3

"the tank"

Claim 3, line 2

Claim 7:

"the coolant"

Claim 1, line 4

"the coolant passage"

Claim 2, line 3

"the coolant circuit"

Claim 7, line 2

Claim 11:

"the boiling cooler"

Claim 1, line 1

Claim 12:

"the liquid refrigerant"

Claim 1, line 5

"the heating element"

Claim 1, line 1

"the refrigerant vessel"

Claim 12, line 3

"the refrigerant vapor"

Claim 1, line 3

"the vapor outflow passage"

Claim 12, line 8

"the heat exchange part"

Claim 1, line 3

"the coolant"

Claim 1, line 4

Claim 13:

"the vapor outflow passage"

Claim 12, line 8

"the heat exchange part"

Claim 1, line 3

"the refrigerant vapor"

Claim 1, line 3

"the coolant"

Claim 1, line 4

"the refrigerant vessel"

Claim 12, line 3

Claim 23:

"the boiling cooler"

Claim 22, line 3

"the radiator"

Claim 22, line 8

"the coolant"

Claim 22, line 4

"the motor"

Claim 22, line 10

Claim 24:

"the radiator"

Claim 22, line 8

"the coolant"

Claim 22, line 4

Reconsideration of the rejection is respectfully requested.

REJECTION UNDER 35 U.S.C. § 102

Claims 1, 2, 3 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Nagakabe Patent No. JP02000022377A. Claim 1 has been amended to define liquid coolant. In the heat exchange part of the present invention, refrigeration vapor is heat-exchanged with liquid coolant and not air as disclosed in JP-2000-022377A. This reference discloses a general air cooled type of cooler which is described in the background of the invention. The present invention improves upon this prior art design by using liquid coolant to heat-exchange with the refrigerant vapor.

Thus, Applicant believes Claim 1, as amended, patentably distinguishes over the art of record. Likewise, Claims 2, 3 and 11 which ultimately depend from Claim

1 are also believed to patentably distinguish over the art of record. Reconsideration of the rejection is respectfully requested.

REJECTION UNDER 35 U.S.C. § 103

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nagakabe Patent No. JP02000022377A in view of Inoue U.S. Patent No. 6,016,966. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nagakabe Patent No. JP02000022377A in view of Benedict U.S. Patent No. 5,421,169. Claims 7 and 12 ultimately depend from Claim 1. As stated above, Claim 1 has been amended and is now believed to patentably distinguish over the art of record. Thus, Claims 7 and 12 are also believed to patentably distinguish over the art of record. Reconsideration of the rejection is respectfully requested.

Claims 22 through 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagakabe Patent No. JP02000022377A in view of Iritani et al. U.S. Patent No. 5,983,652. Claim 22 has also been amended to define a liquid coolant which performs a heat exchange with refrigerant vapor. Neither JP-2000-022377A or Iritani disclose, teach or suggest this feature. Thus, Applicant believes Claim 22, as amended, patentably distinguishes over the art of record. Likewise, Claim s23-25 which ultimately depend from Claim 22 are also believed to patentably distinguish over the art of record. Reconsideration of the rejection is respectfully requested.

NEW CLAIM


New claim 26 is a dependent claim dependent on Claim 1. Applicant believes Claim 26 reads on the elected species.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

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ATTACHMENT FOR CLAIM AMENDMENTS

The following is a marked up version of each amended claim in which underlines indicates insertions and brackets indicate deletions.

1. (AMENDED) A boiling cooler for cooling a heating element, the boiling cooler comprising:
a heat exchange part in which refrigerant vapor performs heat exchange with liquid coolant, the refrigerant vapor being produced from liquid refrigerant that is boiled and gasified by heat transferred from [a]the heating element.

2. (AMENDED) The boiling cooler according to claim 1, wherein the heat exchange part defines therein a vapor passage in which the refrigerant vapor flows, and a coolant passage in which the liquid coolant flows to perform the heat exchange with the refrigerant vapor, the coolant passage adjoining the vapor passage.

7. (AMENDED) The boiling cooler according to claim 2, further comprising a liquid coolant circuit composed of a radiator and a pump for circulating the liquid coolant therein, wherein:

the coolant passage is connected to the liquid coolant circuit; and
the liquid coolant is circulated in the coolant passage by an operation of the pump.

10. (AMENDED) The boiling cooler according to claim 8, wherein:

the first radiator has a lower tank communicating with the vapor outflow passage and the heat exchange part disposed above the lower tank;

in the heat exchange part, the refrigerant vapor is liquefied as condensate by the heat exchange with the liquid coolant;

the refrigerant vessel has a liquid return passage into which the condensate flows from the heat exchange part, the liquid return passage communicating with the vapor outflow passage through the lower tank of the first radiator.

12. (AMENDED) The boiling cooler according to claim 1, further comprising:

a refrigerant vessel storing the liquid refrigerant for transferring the heat from the heating element to the liquid refrigerant to boil the liquid refrigerant, the refrigerant vessel having a boiling portion where the liquid refrigerant boils to produce the refrigerant vapor, and defining therein a vapor outflow passage in which the refrigerant vapor flows toward first and second outlet portions provided both ends of the vapor outflow passage; and

first and second radiators respectively communicating with the first and second outlet portions of the vapor outlet passage, and respectively having the heat exchange part in which the refrigerant vapor is cooled by the heat exchange with the liquid coolant.

13. (AMENDED) The boiling cooler according to claim 12, wherein:

the first radiator has a lower tank communicating with the vapor outflow passage through the first outlet portion, and the heat exchange part disposed above the lower tank;

in the heat exchange part, the refrigerant vapor is liquefied as condensate by the heat exchange with the liquid coolant;

the refrigerant vessel has a liquid return passage into which the condensate flows from the heat exchange part, the liquid return passage communicating with the vapor outflow passage through the lower tank of the first radiator.

14. (AMENDED) The boiling cooler according to claim 1, further comprising:

a refrigerant vessel storing the liquid refrigerant for transferring the heat from the heating element to the liquid refrigerant;

a radiator communicating with the refrigerant vessel and having the heat exchange part for cooling the refrigerant vapor by the heat exchange with the liquid coolant to produce condensate, the refrigerant vapor being produced in the refrigerant vessel by the liquid refrigerant boiled by the heat; and

a refrigerant flow control member disposed between the heat exchange part of the radiator and the refrigerant vessel, and having a control plate that is disposed approximately horizontally to divide a radiator side space from a refrigerant vessel side space and has a plurality of communication ports through which the radiator

side space communicates with the refrigerant vessel side space, the refrigerant flow control member being for controlling a flow of the refrigerant vapor from the refrigerant vessel side space to the radiator side space, and a flow of the condensate from the radiator side space to the refrigerant vessel side space.

22. (AMENDED) A cooling system for cooling a heating element, comprising:

a boiling cooler having a heat exchange part in which refrigerant vapor performs heat exchange with liquid coolant, the refrigerant vapor being produced from liquid refrigerant that is boiled and gasified by heat transferred from a heating element;

a radiator connected to the boiling cooler, for cooling the liquid coolant; and

a motor connected to the boiling cooler in series for supplying the liquid coolant from the radiator to the boiling cooler.

23. (AMENDED) The cooling system according to claim 22, wherein the boiling cooler, the radiator, and the motor constitute a liquid coolant circuit in which the liquid coolant circulates.

24. (AMENDED) The cooling system according to claim 22, wherein the radiator cools the liquid coolant by heat exchange with air flowing outside the radiator.

25. (AMENDED) The cooling system according to claim 22, further comprising a pipe connecting the radiator and a coolant passage defined in the boiling cooler in which the liquid coolant flows.